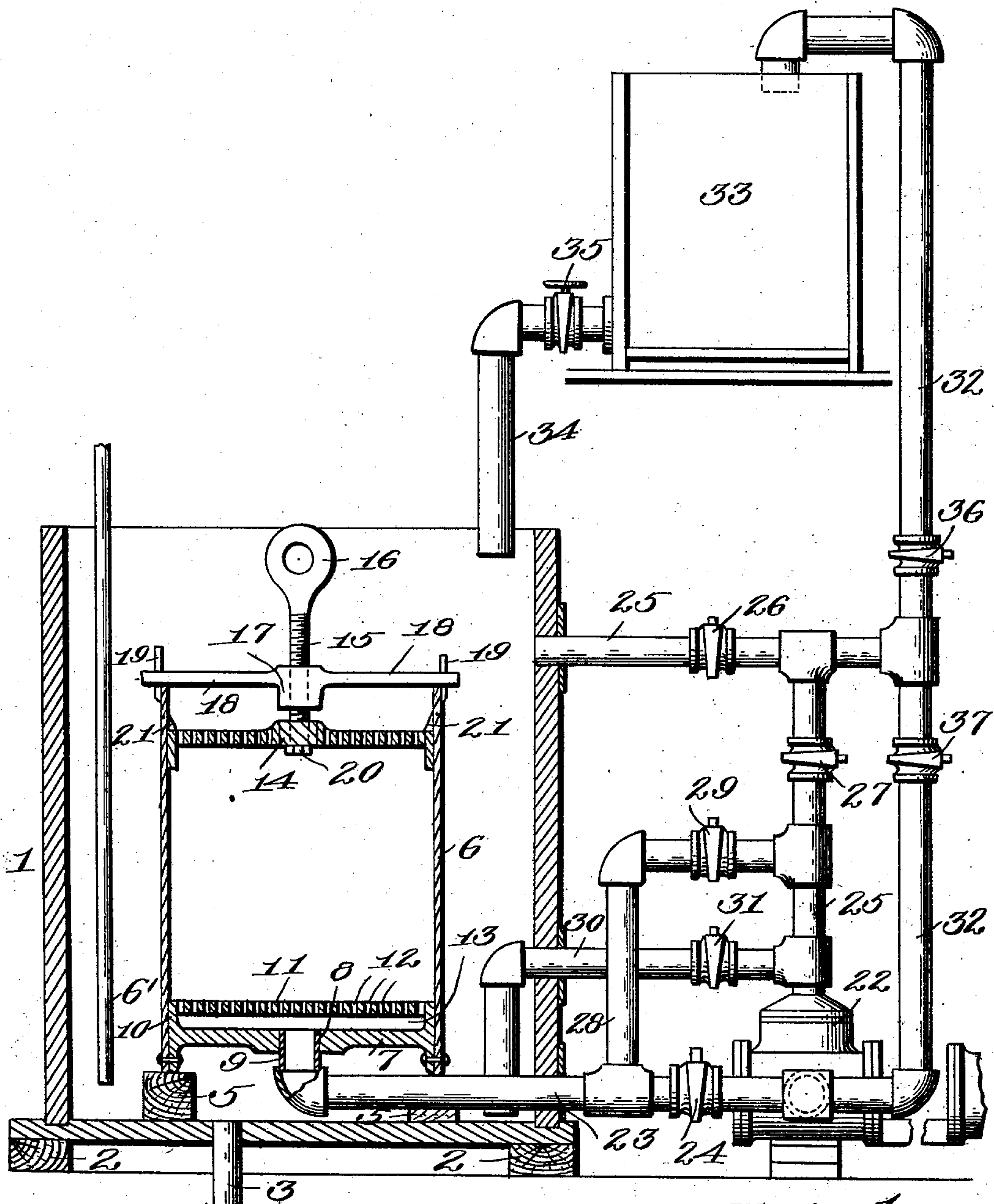


No. 715,719.

Patented Dec. 9, 1902.

J. A. WILLARD.  
APPARATUS FOR DYEING.  
(Application filed Jan. 28, 1902.)

(No Model.)



Witnesses  
C. A. Kessler  
J. B. Kessler

Inventor  
James A. Willard  
By James L. Norris.  
Atty



# UNITED STATES PATENT OFFICE.

JAMES A. WILLARD, OF CHATTANOOGA, TENNESSEE, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO VACUUM DYEING MACHINE COMPANY, A CORPORATION OF TENNESSEE.

## APPARATUS FOR DYEING.

SPECIFICATION forming part of Letters Patent No. 715,719, dated December 9, 1902.

Original application filed December 6, 1901, Serial No. 84,955. Divided and this application filed January 28, 1902. Serial No. 91,632. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES A. WILLARD, a citizen of the United States, residing at Chattanooga, in the county of Hamilton and State of Tennessee, have invented new and useful Improvements in Apparatus for Dyeing Yarns, Hosiery, and other Materials, of which the following is a specification.

This invention relates to certain new and useful improvements in apparatus for dyeing yarns, hosiery, and other materials.

The object of the invention is to dye, wash, and fix the dyestuff on the yarns, hosiery, and other material while they are submerged at all times without coming into contact with air and until the color has been set and made fast or permanent.

The invention aims to provide an apparatus particularly adapted for use in dyeing yarns, hosiery, and other materials with sulfur blacks, although the same is applicable for use with other characters of dyes. It is a well-known fact that sulfur blacks have been in existence for a number of years; but there has been no practical way to use these colors for the reason that if the material to be dyed or if the material during the dyeing operation comes in contact with air it oxidizes and becomes spotted. By the apparatus to be hereinafter described it is impossible for the air to strike the material while being dyed, as the material at all times is immersed in the liquid during the dyeing operation and also during the washing operation.

A further object of the invention is to provide an apparatus in which all the material being dyed receives the same treatment—that is to say, during the dyeing operation the dye liquor is forced alternately in opposite directions through the material. Consequently the lower portion of the material will receive the same action, as well as the upper portion, thereby obtaining a uniform dyeing.

A further object of the invention is to provide an apparatus of the class referred to wherein the dyeing operation will be expedited to such an extent that a great saving of time is obtained over the method now generally employed, or, in other words, the time

consumed in dyeing a quantity of yarn, hosiery, or other material by the employment of the apparatus hereinafter described is approximately one and a half hours, while the time consumed in dyeing the same quantity of yarn, hosiery, or other material by the oxidizing method now in general use is from twenty-four to forty-eight hours.

In describing the invention in detail reference is had to the accompanying drawing, forming a part of this specification, and which illustrates a sectional elevation of the apparatus.

Referring to the drawing by reference-numerals, 1 denotes an open vat or outside tank which is preferably supported upon the base 2 and is provided in its bottom with an outlet-pipe 3 for the discharge of waste water, the pipe 3 having a suitable cut-off 4. Within the tank 1 is a support 5 for the material holding and dyeing cylinder 6.

The reference-numeral 6' denotes a steam-pipe which extends within the vat or tank 1 for heating the dye liquor.

The cylinder 6 is provided with a bottom 7, suitably secured thereto in any desirable manner, and is formed with a centrally-arranged opening 8, in which is secured a depending collar 9. The upper face of the bottom 7 is formed with an upwardly-extending annular flange 10, to which is formed integral a plate 11, provided with a series of perforations 12. This plate 11 is arranged a suitable distance above the bottom 7, forming thereby a chamber or auxiliary reservoir 13 for the liquid as it passes through the material and before it is discharged from the cylinder.

The reference-numeral 14 denotes a removable as well as a vertically-adjustable perforated cap or head for the cylinder 6. This cap or head 14 is provided with a centrally-arranged screw-threaded opening to receive a vertically-extending adjusting-screw 15, having its upper end formed with an eye 16 to receive a suitable means (not shown) for operating the screw. The screw 15 passes through a guide-sleeve 17, which is or may be formed integral with a pair of supporting-arms 18, adapted to be mounted upon the top



edge of the cylinder 6 between two pairs of guide-lugs 19, which are or may be formed integral with the top edge of the cylinder 6. The lower end of the screw 15 is provided with a stop-nut 20. The head 14 when placed within the cylinder is arrested in its upward movement by means of the stops 21, or, in other words, the head 14 is removably secured within the cylinder in such a manner as to limit its upward movement, but not its downward movement.

The reference-numeral 22 denotes a rotary or steam pump which is in communication with the cylinder 6 by means of the lower circulating-pipe 23, the latter having its inner ends secured to the collar 9, its outer end to the pump, and provided intermediate its ends with a straightway-valve 24.

The reference-numeral 25 denotes an upper circulating-pipe which communicates with the vat 1 and with the pump 22 and is provided with straightway-valves 26 27.

The reference-numeral 28 denotes a connecting-pipe member between the pipes 23 and 25. This member 28 is provided with a straightway-valve 29.

The reference-numeral 30 denotes a suction-pipe which communicates with the vat 1 and the pump 22 and is provided with a straightway-valve 31.

The reference-numeral 32 denotes a suction-pipe for establishing communication between the pump 22 and the mixing and storing-tank 33, which is usually arranged above the tank 1 and from which the dye liquor is discharged by means of the feed-pipe 34. This latter pipe is also provided with a straightway-valve 35. The suction-pipe 32 communicates with the circulating-pipe 25 and is provided with a straightway-valve 36 above its union with the pipe 25 and a straightway-valve 37 below its union with the pipe 25.

The apparatus is operated in the following manner: The cap 14 is removed and the cylinder 6 is filled with, say, one hundred pounds of yarn or hosiery, as the case may be. The cap 14 is then placed within the cylinder and suitably secured thereto. Then the screw 15 is screwed down until the material is well compressed, forming substantially a solid mass. Dye liquor which has been previously mixed in the tank 33 is then allowed to run down through the pipe 34 into the vat 1. Steam is then admitted to the pipe 6', and when the dye liquor in the vat 1 is heated to 190° the pump 22 is started and the operation continues as follows: The valves 36, 37, 29, and 31 are closed. The pump 22 will then get its suction through the pipe 25. The liquor flows by gravity to the pump through pipe 25 and is then forced by pressure of the pump 22 through the pipe 23, through the bottom 6, the perforated plate 11, through the material to be dyed, passing out through cap 14 and into the pipe 25, which completes the circuit, making the circulation complete. This continues for about thirty minutes, when the cir-

ulation is reversed, as follows: Valve 29 is opened, valves 24 and 27 closed, valve 37 opened, and valve 36 remaining closed, as before. The pipe 23 becomes the suction-pipe, the dye liquor passes through the pipe 23, pipe 28 and the lower portion of pipe 25, and to pump 22, and is then discharged into the lower portion of pipe 32 into the upper portion of pipe 25 and thence into the tank. This completes the circulation again, and the pump is allowed to continue the circulation for thirty minutes or until the material is properly dyed. The material is then ready to be washed and softened, and after the direct dyeing is finished pump 22 is stopped and valves 26, 29, and 24 are closed. Valves 36, 37, and 31 are opened. The pump 22 is then started, and the dye liquor is forced into the tank 33 from the tank 1 through the pipes 30 and 32. Of course it will be evident that when the liquor is brought back to the tank 33 it can be used over again. After the liquor has been removed from the vat 1 the dyed material is then ready for washing. The tank 1 is filled with water, and the circulation is started, as above set forth in connection with the first circulation of the dye liquor. The circulation of the water through the material continues about five minutes. The circulation is then reversed for about five minutes, or until the material is cleaned, or until the wash-water becomes clear. The first wash-water is always to be retained and pumped into the mixing-tank. The remaining washes are allowed to be discharged through the pipe 3, the valve 4 being opened for this purpose. The material is then ready to be extracted and finished, the whole time consumed not being over one and a half hours.

It will be evident that owing to the compression of the material to be dyed the same will form a substantially solid mass and will also give a certain amount of resistance to the pump. It also insures a more uniform dyeing, as each and every portion of the material offers the same resistance to the dye liquor. It will also be evident that if the material was placed in a loose condition within the dyeing-cylinder the liquor would have a tendency to pass around the material and not directly through the material, as would be the case when it is compressed, or, in other words, the loose placing of the material within the cylinder will form passages through which the dye liquor will be forced, whereas if the material is compressed the same will be substantially a solid mass, so that, as above stated, a uniform dyeing is obtained, as each and every portion of the material offers the same resistance to the dye liquor, or, in other words, the dye liquor passes through the material in a uniform manner.

It is well understood by every dyer that cotton yarn will not take up the dye matter readily; but by the operation of the apparatus hereinbefore set forth the dye liquor is forced through the material, leaving the dye-



stuff on the same, and the water passes out. This is continued until the bath is exhausted and it is to be replenished to dye the second lot. It will also be evident that by the employment of the apparatus the dye liquor is saved and can be used over again.

It is thought the many advantages of my improved apparatus for dyeing yarns, hosiery, and other materials can be readily understood from the foregoing description, taken in connection with the accompanying drawings, and it will also be noted that minor changes may be made in the details of construction and arrangement of the various parts without departing from the general spirit of my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an apparatus for dyeing, a vat, supports arranged therein, a cylinder having an open top and a closed bottom mounted upon said supports, a perforated plate integral with said bottom arranged above the same forming thereby a chamber, a vertically-adjustable perforated cap for the top of said cylinder, means for adjusting said cap, a pump, a pipe connection between the bottom of said cylinder and said pump, a pipe connection between the bottom of said vat and said pump, a pipe connection between the upper portion of said vat and said pump, a mixing and storing tank, a pipe connection between said pump and said tank, and means for establishing communication between said tank and said vat.

2. In an apparatus for dyeing, a vat, a cylinder mounted therein, a perforated cap adjustably mounted within said cylinder near the top thereof, a perforated plate arranged in said cylinder at the bottom thereof, a pump, a lower circulating-pipe 23 communicating at one end with said cylinder and at its other end with said pump, a valve in the said circulating-pipe, an upper circulating-pipe 25

communicating at its upper end with said vat near the top thereof and at its lower end with said pump, a pipe for connecting the two circulating-pipes together, a pair of valves provided in said upper circulating-pipe, a valve provided in said connecting-pipe, a suction-pipe 30 communicating at one end with said vat and at its other end with said pump, a valve in said suction-pipe, a mixing and storing tank, a suction-pipe 32 communicating at its lower end with said pump and at its upper end with said tank, said suction-pipe communicating with said upper circulating-pipe, a valve arranged in the upper portion of said suction-pipe 32, a valve arranged in the lower portion of said suction-pipe 32, and means for establishing communication between said tank and said vat.

3. In an apparatus for dyeing, a vat, a cylinder adapted to receive the material arranged in the said vat, and provided with a perforated cap near the top thereof and a perforated plate near the bottom thereof, a pump, a lower circulating-pipe 23 communicating with said cylinder and said pump, a valve arranged in said pipe, an upper circulating-pipe communicating at its upper end with said vat near the top thereof and at its lower end with said pump, a pair of valves arranged in the said upper circulating-pipe, a suction-pipe communicating at one end with said vat and at its other end connected to said lower circulating-pipe, a valve arranged in said suction-pipe, a connecting-pipe communicating at one end with the lower circulating-pipe and at its other end with the upper circulating-pipe, and a valve arranged in said connecting-pipe.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JAMES A. WILLARD.

Witnesses:

R. H. WILLIAMS,  
CHAS. S. HALL.